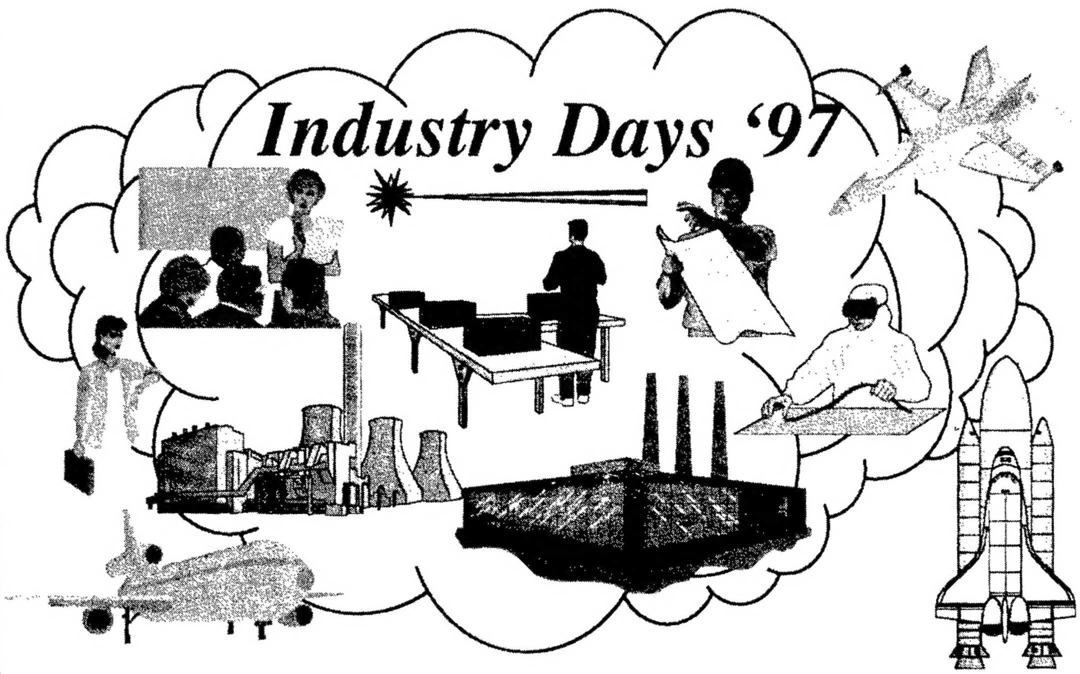
Spring 1997

The USAF Manufacturing Technology

PROGRAM STATUS REPORT

Wright Laboratory / Manufacturing Technology Directorate / Wright-Patterson AFB, Ohio
Visit the ManTech Homepage at: http://www.wl.wpafb.af.mil/mtx/mt_home.htm



After wrapping up 1996 with the Defense Manufacturing Conference in Miami Beach, the Wright Laboratory Manufacturing Technology Directorate is gearing up for its third annual Industrial Base Pilots Industry Days Conference, April 8-9. It's also preparing a Roadmap Review, to be held in conjunction with the U.S. Air and Trade Show, which will honor the 50th anniversary of the Air Force.

In this issue:

Manufacturing representatives gather in Miami for 1996 Defense Manufacturing Conference

Representatives from the government, academia, and industry gathered in Miami Beach recently, for the 1996 Defense Manufacturing Conference.

The Wright Laboratory Manufacturing Technology Directorate (MT) was a key participant at the Joint Directors of Laboratories Manufacturing Technology Panel-hosted event, which took place Dec. 2-5, at the Fontainebleau Hilton Hotel & Towers. The theme of this year's conference was "Issues and Challenges for the 21st Century."

Lt. Gen. Kenneth E. Eickmann, Aeronautical Systems Center commander, was among the distinguished visitors attending the event. He participated in a panel discussion on the customer perspective on affordability across the life cycle, along with Dr. Fred E. Saalfeld, deputy chief of Naval Research; Admiral (Ret) Frank B. Kelso, former chief of Naval Operations; Rear Admiral Paul M. Robinson, vice commander, Naval Sea Systems Command; Maj. Gen. Roy E. Beauchamp, deputy chief of staff for Research, Development and Acquisition; and Brig. Gen. Joseph T. Anderson, deputy commander, Naval Air Systems Command.

Also among the attendees at DMC '96 were: Deputy Secretary for Defense (Logistics) John F. Phillips; Assistant Secretary of the Navy John W. Douglass; Executive Secretary Defense Manufacturing Council, Robert E. O'Donohue; Deputy Director Defense Research & Engineering, Dr Lance A. Davis; and Executive Director Manufac-

Lt. Gen. Kenneth E. Eickmann, Aeronautical Systems Center Commander, reviews the Manufacturing Technology Directorate display at DMC '96, with Dr. William C. Kessler, MT Director. Michael Baker (right), from MT's advanced practices deployment branch, was at the display to explain the Operation Network Industrial Base Simulation.

turing, Defense Advanced Research Projects Agency, Dr. Michael F. McGrath.

Approximately 830 attendees were provided an overview of defense manufacturing, which included detailed discussions related to various manufacturing initiatives and current technology thrusts. The status of both industry and government programs was presented with a vision for the future of defense manufacturing and industrial modernization.

More than 70 government and industry exhibits were on display for the duration of the conference. The MT display played a prominent role, highlighting current programs which reduce weapon systems cost and enable advanced performance. Much of the conference centered around technical sessions and mini-symposiums, which addressed metals processing, composites processing, electronics processing, manufacturing and engineering systems, advanced industrial practices, best manufacturing practices, and several special topics.

Dr. William C. Kessler, Director of MT and Chairman of the JDL, Manufacturing Technology Panel, moderated the DoD Manufacturing Technology Program on Issues, Direction and Funding. Many other MT people had active roles in the conference.

Richard Remski chaired the mini-symposium for Electronics Processing and Manufacturing, participated on a panel on Technical Track Highlights, Future Direction and Funding, and moderated a session on microwave power amplifiers. Michael Marchiando moderated the Electronics session on Commercially Manufactured Parts Utilization. Anthony Bumbalough gave an Air Force Manufacturing Technology perspective on Commercial Components, and James Neely discussed Air Force Material Command Diminishing Manufacturing Sources and Material Shortages Management Activities.

In the area of Advanced Industrial Practices (AIP), John Fenter was the mini-symposium chairman, and he also participated on the Technical Track Highlights panel. John Cantrell gave an update on the Lean Aircraft Initiative. While moderating the session on "Getting Lean - Enterprises for the 21st Century," Brench Boden gave a presentation on "Realizing the Lean Factory - Modular Factories for Defense Production." James Poindexter spoke on Simulation Assessment Validation Environments, Alan Herner discussed the Joint Strategic Fighter Manufacturing Demonstration Program, and Mary Kinsella led a session on "Being a Good Customer." Michael Hitchcock moderated a joint session on "Supply Chain Management - Keys to Affordability and Streamlining," and also spoke on Air Force Investment Opportunities in Supplier Development and Management.

Mini-symposium chairman for Composites Processing and Manufacturing was David Beeler, who also sat on the Technical Track Highlights panel. Diana Carlin moderated a session on Composites Processing and Manufacturing Affordability, and Daniel Brewer spoke on the Composites Affordability Initiative.

A session on Quality in Metal Processing was guided by Stephen Thompson and Patrick Price led a session on Missile Sector Supply Chain Management.

Persis A. Elwood briefed on the Sustainment Working Group. She will be the Air Force project officer for next year's conference, which will combine with the annual Sustainment Conference. This is currently scheduled for Dec 1-4, in Palm Springs, CA.

Manufacturing Technology
USAF

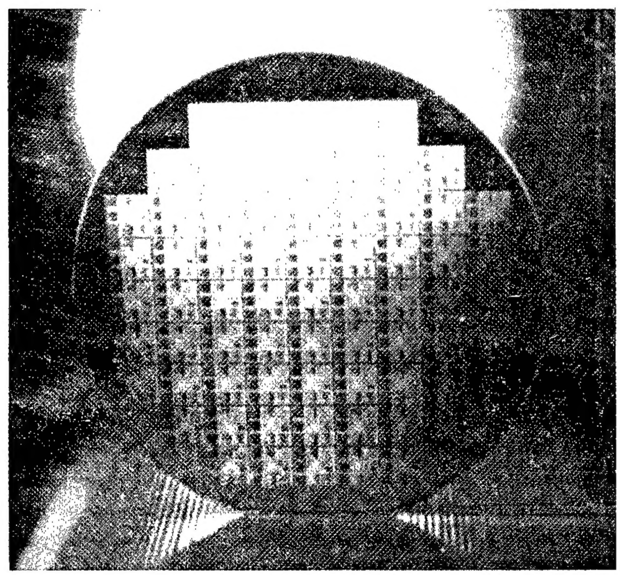
Title III establishes domestic production capability for radiation hardened wafers

The Defense Production Act (DPA) Title III Program Office brought Union Carbide Corporation (UCC) and Wright Laboratory together to establish an annual domestic production capacity of more than 50,000, high-quality four-inch silicon on insulator/silicon on sapphire (SOS) wafers. SOS wafers provide a radiation-hardened substrate on which small integrated circuits and electronic devices are built. Many military electronic systems, especially space satellites, must withstand extended exposure to radiation (natural or from nuclear weapons detonated in space), and UCC can now produce radiation hard SOS wafers.

The source for SOS wafers is a large cylindrical crystal of synthetic sapphire called a "boule." The boules are ground to uniform diameters, and thin wafers are then cut from the boule. The wafers are then ground, polished, measured, and tested to meet exacting specifications. The final product then serves as the basic material from which electronic circuits are built. In an effort to ensure Department of Defense (DoD) access to domestically produced SOS wafers, the Title III Program Office contracted with UCC, of Washougal, Wash., for extensive technical and production oriented activities. Title III is unique among other government programs in that beyond providing an incentive for the domestic production of a critical defense product, it also seeks to aid the establishment of viable, continuing industrial capacity to supply defense and commercial needs. UCC was motivated to share the costs and risks of establishing a domestic SOS wafer production capability, since the project committed the government to purchasing a number of the SOS wafers over two years of production. Meanwhile, sales of the wafers to other users expanded UCC's market and made the wafers more affordable. This condition satisfied a growing commercial demand for the wafers and met the military's requirements as well.

The success of this $23 million program gives DoD a domestic source of affordable, world-class SOS wafers. Title III provided the incentive for UCC to refine, expand, and improve its processes for the production of the wafers. UCC's investment in equipment and a strong emphasis on quality improvement (UCC received ISO 9002 quality certification during this project) also reduced process steps by 23 percent. These process improvements helped to increase yields from each boule from 70 to 90 percent, which resulted in affordability gains that were passed on to several military programs. Process improvements also enabled UCC to penetrate international markets and provide the company with a commercial business base that ensures a reliable source for the U.S. military.

For more information, circle Reader Response Number 1



The SOS wafer shown has integrated circuits attached. The Title III Program is credited with providing UCC with the economic incentive to establish a domestic production of affordable, world-class SOS wafers.

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Lean Aircraft Initiative enters Phase II - Lean Space Initiative briefed to SMC, BMDO

The Lean Aircraft Initiative (LAI), a consortium of government, industry, labor and academia partners working to implement lean principles and practices in defense aerospace, entered Phase II recently.

LAI Phase II vision and goals include significantly reducing the cost and cycle time for military aircraft throughout the entire value chain, while continuing to improve product performance; integrating research thrusts on cross-cutting topics; developing the Lean Enterprise Model (LEM) and populating it via benchmarking, case studies and research; facilitating and enabling enterprise-wide, systemic exchange among LAI members; extending and enhancing the collaborative nature of the project; and telling the LAI story.

Responding to LAI Executive Board guidance, the MIT team broadened the member participation in and funding base for LAI; formed beneficial, strategic alliances with such entities as the International Motor Vehicle Program (IMVP), the Fast and Flexible Program, and the International Center for Research on the Management of Technology; updated the research structure at MIT; and streamlined member/stakeholder roles in the overall LAI process.

Next steps for the MIT team include developing a second-generation LEM, building further on the school's previous work with the IMVP; making LEM easily accessible via the World Wide Web; creating electronic linkage between MIT and its LAI partners, for continuous benchmarking; and generating a user-friendly, Virtual Electronic Library, with topic research capability and linked to related databases and bibliographic references.

An organized compilation of LAI research findings, LEM is a framework of lean principles, practices, metrics, enablers and barriers to leanness, and ways to overcome those barriers. A tool to be used within the enterprise to help in assessing leanness and establishing guidelines for movement toward lean practices, LEM will help members gain insight into pathways through which lean practices might be used, and consider strategies for implementation.

"The spirit of collaboration within LAI and its broad implications on defense product cost reduction continue to accelerate," said Dr. Bill Kessler, a leader within LAI and director of Wright Laboratory's Manufacturing Technology Directorate (MT). "MIT is pioneering new ways to conduct relevant research, and we are finding that implementation is rapid. The concepts and realities of lean are now being propagated throughout the supply chain, with our LAI members taking on increasing leadership.

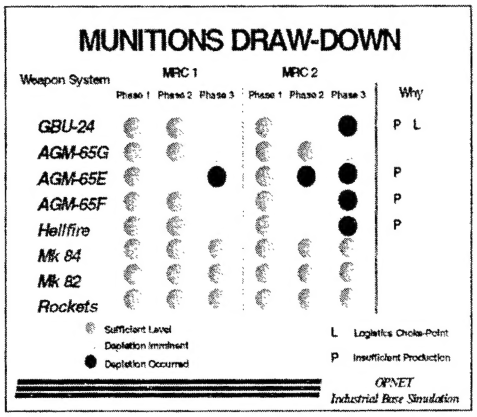
"With the help of the LAI Executive Board, the project is actively pursuing greater affordability of systems, increased efficiency, high quality, enhanced technological superiority, and a stronger U.S. industrial base supporting defense product realization," Dr. Kessler said. "The group's aim is to bring the very best of lean principles and practices to all Air Force acquisitions — such as near-perfect, first-time quality; waste minimization; continuous improvement; flexibility; and long-term relationships."

The Lean Space Initiative (LSI) was also discussed recently in a briefing to the Space and Missile Center Commander and his Program Directors, eliciting a positive response. Constructive questions were asked by SMC management and the formal go-ahead was given for the LSI Quick-Look Study. The LSI Integrated Product Team met following the briefing to discuss the strawman concept of operations and proposed research topics and to plan for the LSI stakeholders' meeting. MT's Dick Remski briefed Ballistic Missile Defense Office Director Lt. Gen. Lester Lyles on LSI status, with very positive results. Lt. Gen. Lyles requested MT representatives meet with him soon to provide a more detailed update on LSI and LAI progress.

OPNET Industrial Base Simulation addresses concerns with U.S. industrial readiness

The Air Force is sponsoring the development of OPNET (Operation Network) Industrial Base Simulation to address concerns with US industrial readiness. The program has two primary objectives: to identify current and/or future shortfalls in War Reserve Materiel, specifically war-consumable items such as air-launched munitions; and to estimate the recovery time to rebuild combat capability to a specified level of readiness.

OPNET provides animated views of production for US defense-based assets and the movements of those assets during the conduct of operations, both in peace-time and during war mobilization. It graphically links war-fighting requirements with the supply and replenishment capability of the supplier base. It is designed in three definitive modules: supply and logistics; draw-down or expenditure; and replenishment.



The supply and logistics module provides quantity and location of various assets and can track movement of those assets during peace-time and mobilization operations. The draw-down or expenditure module allocates resources (aircraft, weapons, sorties, etc.) against targets in an optimal manner using linear programming. Both of these modules are quick-look simulations that can be replaced with other logistics and conflict models, or the resultant information can be fed automatically or manually into the replenishment module.

The replenishment module is the industrial base simulation portion and is a stand-alone module. This module is complete -- a user-friendly compiled software package on CD that allows for construction of industrial base hierarchy "trees" supporting multiple systems with interconnects down to the fifth tier. It can be used to explore risk, cost, budget, schedule and acquisition management options. The replenishment module includes an Analysis Engine, OPNET Enhancement, Navigation Features, and Data Input Enhancement.

The Analysis Engine can read variables, track costs, chokepoints, capacities and other production information and create contractor schedules. OPNET Enhancements include the "point and click" capability to build vertical supplier infrastructures, assign relationships such as customer and supplier, and provide recall and redraw memory features. Navigation Features include the ability to scroll and view supplier infrastructures, identify the supplier customer realm for a particular system, and establish the OPNET basis for production planning graphics and factory history graphics. The ability to automatically populate OPNET comes from Data Input Enhancements, which include the capability to format, read and write both external and internal files, assign file information to the variable fields, establish input status of information with an indicator state, provide for retention of variables in the OPNET data base, update the files required to run the regeneration module and prepare generated data for output. This module allows "what if" scenarios to be analyzed graphically. What if a supplier disappeared? What if rate cannot be met? Will extended shifts, double shifts be able to meet demand?

OPNET allows an operator to quickly and easily measure the impact of subtle changes in conflict or pre-conflict conditions on the overall outcome of the campaign. It can be used by engineers, program managers and finanicial analysts in virtual and lean manufacturing analyses, and is resident on a Pentium laptop compatible with Windows-95. OPNET is not limited to munitions, but can be used for multi-spectrum commodity planning, and should be considered in setting up airbases overseas on short notice, joint-service wargames, future technology planning, and production endeavors from defense to commercial applications.

For more information, circle Reader Response Number 2

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Directorate prepares for third annual Industrial Base Pilots Industry Days, April 8-9

The Wright Laboratory Manufacturing Technology Directorate will hold its third annual Industrial Base Pilots Industry Days event April 8-9, at the Crown Plaza Hotel, in Dayton, Ohio.

The theme, "Implementing Lean Practices," reflects the focus being placed on the Integrated Product Team's (IPT) programs and their efforts to implement lean practices into major Department of Defense programs and industry.

At last year's event, reviews of ongoing pilot programs were presented. A common goal existed of overcoming cultural problems between the military and industry when changing the way business is conducted. Heavy snow didn't stop the 168 people who came out to discuss various ways of implementing best practices in interactions between the military and industry. Attendees reviewed efforts toward achieving this goal through reduced cycle time, enhanced affordability, and improved quality.

The Air Force has been working with industry and academia to change the way the Department of Defense buys and manufactures military hardware. The Aeronautical Systems Center's Lean Aircraft Initiative (LAI) recently entered its second phase of study with hopes of involving new members in its quest for the lean enterprise. MT's IBP programs have made major strides in transitioning commercial best practices from the laboratory environment into major production programs. The new Lean Implementation Initiative is well underway, and the directorate is planning for additional new programs. Industry Days gives the directorate an opportunity to share the results of their efforts with others interested in doing things "better, faster, and cheaper."

Day one of the event will begin with an overview of Lean Initiatives. Experts in business practices, manufacturing infrastructure, process technology and product users are all scheduled to speak, with each group providing specific details on implementation. The scheduled keynote speaker is James Sinnett, Corporate Vice President of Technology for McDonnell Douglas Corporation. Organizers have also arranged a special luncheon presentation by Thomas J. Doyle, vice president and general manager of TRW.

On the second day, presentations containing even greater detail will be provided describing how these lean practices are being applied to commercial production facilities and can potentially impact programs across the entire DoD. The scheduled luncheon speaker is Fred Stahl, Director of Production Transition, McDonnell Douglas Aerospace.

For more information or to register, contact Tracy Tapia at Universal Technology Corporation, (937) 426-2808.

MT Roadmap Review coming July 17-18 in conjunction with local air show

The Wright Laboratory Manufacturing Technology Directorate will host its annual Roadmap Review July 17-18, in the Dayton Convention Center. The purpose of the review is to provide direction and guidance to the defense manufacturing community. Leaders from academia, industry, and government agencies will be in attendance to hear the directorate engineers discuss program accomplishments, present planning activities and future new starts.

The event will be hosted by the MT Director, Dr. William C. Kessler, who will provide a complete overview of the Directorate. Dr. Kessler will give a progress report on the Directorate's mission to help industry maintain an affordable defense manufacturing capability in an era of downsized budgets.

MT's integrated program strategy will be the topic of the next portion of the day's briefings. Findings from the Joint Defense ManTech Panel, and ManTech Roadmaps will be presented.

The Review will be devoted to future plans and projects. Each of the Directorate's major thrusts will be examined with an eye to plans and strategy. For more information contact the Universal Technology Corporation, (937) 426-2808.

Open Matrix Distributed Software System major force in evolution of worldwide web

The Open Matrix Distributed Software System project was a major force in the evolution of the World Wide Web, the client-server technology that has revolutionized Internet-working across both military and civilian applications. This influence spans several key technology areas: browser features, security protocols, security infrastructure, directory indexing, server installation, site maintenance, and service programming. In each of these areas, this effort demonstrated what is possible, or deployed the technology that is still in use.

This project, sponsored by the Defense Advanced Research Projects Agency (DARPA) and monitored by the Wright Laboratory Manufacturing Technology Directorate, was chartered to produce enabling technologies for engineering applications over wide-area networks. It did this and much more, playing a significant role in taking the web from what was an obscure technical publishing prototype, into the defacto world infrastructure for electronic commerce. The program successfully implemented a bottom-up tech transfer strategy that synergized with the way Internet technology was evolving and produced 10 different Internet software packages. These were distributed under freeware licenses across the Internet and many are still in use.

People have been building infrastructure to support their applications for as long as they have been writing programs. They built many programs using different (but usually homogeneous) infrastructures. Large and complex distributed systems have survived by building ever higher layers of infrastructure. Something other than another layer of meta-infrastructure was needed to stop spiraling costs and give users confidence that the plethora of interesting applications that have been developed, and will continue to be developed, can somehow have a chance of working together. What was needed was an infrastructure that can itself change, adapt and grow, not just in the number of agents or services, but in the details of the internal protocols as well.

For more information, circle Reader Response Number 3

Open Matrix produced several software packages that demonstrated what was possible with Internet electronic commerce. *ServiceMail* gave hundreds of users a convenient email-processing service and demonstrated the first multimedia email parts ordering and fabrication service. The *Enterprise Integration Technology, Inc. (EIT) Web Browser* was the first browser on the Microsoft Windows NT platform and the first to demonstrate a hyper text markup language (HTML) forms capability. Though the full browser was never distributed, the underlying Windows port of the *libwww* library was used by the National Center for SuperComputing Applications (NCSA) to Web-enable their famous *NCSA Mosaic for Windows* program. *The Webmaster's Starter Kit* was the first web software package to automatically configure the distribution during the download process; the first package to use HTML forms for server administration (later adopted by Netscape and others); the first modular server package; and the first HTML wizards for HTML page generation (also adopted by Netscape and others). This kit was a critical resource in initial site deployment, and *Prodigy Online Services* reported that the kit was an important tool used when they were starting their Web services. *Secure NCSA Mosaic* and *Secure NCSA Hyper Text Transfer Protocol (HTTP)* were the first Web browser and Web server (respectively) to employ public-key cryptography for secure Web applications. They operationally demonstrated how public-key technology could be used for privacy, digitally-signed documents, and authenticated requests. *Hypermail* was one of the first packages to integrate email archives with Web pages and after two years and thousands of downloads, is still a favorite piece of Web server freeware. *Swish/WWWWais* was the first search indexing/retrieval package designed especially for Web sites. *LibCGI* was the first C-language Common Gateway Interface programming library. Open Matrix software packages also formed the technological basis for several new pilots, products and startup companies.

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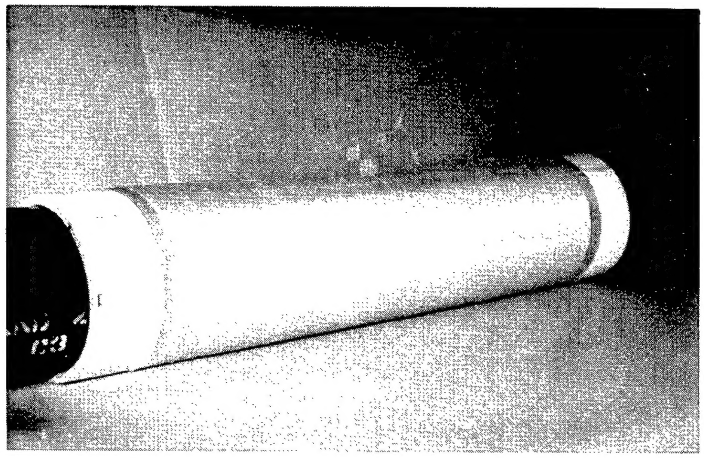
Contract Number:
F33615-93-C-5314

Dynamic Polymer Composite Connectors for Affordable Composite Structures

This program successfully developed a new joining technology for tubular composite sections which will result in affordable structural connections for composite aircraft. The Dynamic Polymer Composite (DPC) connector has a cost advantage of 25 to 45 percent in commercial use, and this potential aerospace cost savings has attracted McDonnell Douglas, Bell and Boeing. The joining technology developed is on the brink of creating new markets for composites in oil and gas production, process industries, hazardous materials handling, and civil structures. Eight major market segments have been identified with a total potential market of over $200 million.



Kevlar filament winding

The Technology Partnership, working with engineers from the Wright Laboratory Manufacturing Technology Directorate, developed a heat-shrink structural connector for tubular airframe sections. DPC connectors have high-modulus fibers that are pre-stressed during manufacture to be released during assembly when the polymer matrix is heated. To assemble, tubular members are fitted into a DPC sleeve, which when heated, clamps to the members to create a smooth stress flow between cylindrical structural members. Based on this technology, the Directorate can develop their vision of the future composite aircraft; one where avionics, piping, and raceways are all integrated with the structure. The result would be a composite airframe which can be repaired by component replacement under forward theater operations.

Decreasing defense budgets along with increasing commercial requirements necessitate the development of low cost organic matrix composite structures. A large percentage of the costs are associated with assembly and repair of composite structures. Prior to this effort, there were no available joining methods that lend themselves to quick and easy field assembly and repair of aircraft composites. Joining concepts are required which: 1) may be used under field conditions with a minimum of tools/equipment, 2) develop an adequate portion of the strength of the structural members themselves, 3) minimize or eliminate surface preparation, and 4) minimize the need for precise dimensional tolerances.

The Technology Partnership used their patented Dynamic Polymer Composite technology to meet the challenges of creating a structural connector that could be used in the field for either repair or assembly. The connector requires little surface preparation, requires few tools, develops most of the strength of the structural members themselves, and saves money over unit cure and hand lay-up methods of joining. The contractor worked with the University of Dayton's Research Institute and Wayne State University's Advanced Composite Research Laboratory in tapping material data to model, design and demonstrate a connector that both generates force and resists applied force. Connectors were built with fibers pre-stressed to 270,000 psi. This stored energy was constrained until activation and as it was heated, the thermoplastic composite matrix was compressed to conform to the surface of the pipe members being joined. Variations in surface and dimension were filled with the heated thermoplastic. Sizable bond strength developed when the connector cooled to form a rigid, sealed structural joint between structural composite pipe sections.

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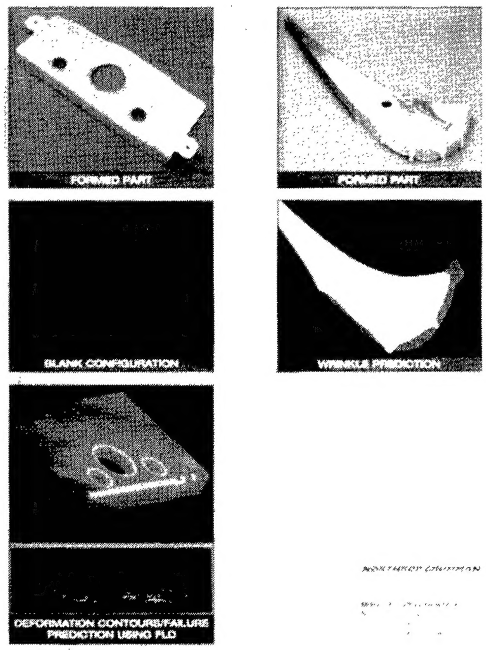
Contract Number:
F33615-96-C-5622

For more information, circle Reader Response Number 4

Metal forming simulation process reduces cost, improves quality

This program improved product quality, reliability, and reproducibility while simultaneously reducing turn-around time and cost of fabricating sheet metal aircraft parts. The effort established a three-dimensional (3-D) computer-aided design/computer-aided manufacturing/computer-aided engineering (CAD/CAM/CAE) system to simulate the Fluid Cell sheet metal forming process. The system predicts anticipated forming defects such as tearing and wrinkling and provides a solution to eliminate the defect during the design or manufacturing. It also provides critical parameters for tool design. Benefits include elimination of scrap, substantially reduced throughput time, reduced part variability, elimination of trial-and-error in tool and part fabrication, and a potential cost savings of $1 million per year when fully implemented to replace current operations at Warner Robins Air Logistics Center (WR-ALC).



Metal forming simulation

Under a contract with the Wright Laboratory Manufacturing Technology Directorate, Northrop-Grumman Corporation conducted a needs analysis and established system requirements for the WR-ALC system. This system is capable of being integrated into WR-ALC forming and machining operations. The system models the cold forming of aluminum and steel sheet metal components using the Fluid Cell forming process for the F-15, C-130 and C-141 aircraft at WR-ALC, in particular, and is capable of modeling sheet metal components 10 times larger, as those found on the C-5 aircraft. This system develops a 3D CAD model from the actual part, develops a blank shape of the part, calculates the tool parameters, evaluates the producibility, and modifies/optimizes the manufacturing process. The system provides intuitive user interface, accurate results, fast execution, extensive material database, automatic meshing, unique contact algorithms, prediction of springback, crack and wrinkling, prediction of forming pressure, and suggestion for alternative design/process in case of failure. Based on military parts that have been formed at Northrop using this system, handwork has been reduced by 90 percent, rejection rate has been reduced by 95 percent, the capability index number (Cpk) has approached 1.3, and the cycle time has been reduced by 78 percent. The Air Force expects to realize the same magnitude of benefits when the system is installed at WR-ALC.

Rubber pad forming (Fluid Cell process) is one of the important methods of forming aluminum sheet parts to repair airframes at WR-ALC. Part of the WR-ALC mission is to support and repair the F-15, C-130, and C-141, which includes delivering a high quality product in the shortest amount of time, and at a low cost. Prior to this effort, WR-ALC had difficulty in fabricating aluminum sheet parts resulting in dimensional inaccuracies and defects. They produced a high quality part, but the cycle time was too long and the cost was too high. The forming dies were designed by trial-and-error and the experience-based die design practice was costly

For more information, circle Reader Response Number 5

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F33615-93-C-5318

and often required long-lead times. This is a problem common to many ALCs, the Army and Navy, and to the aerospace industry depot maintenance operations. The contractor developed a computerized, simple-to-operate, analytical model, which describes the formability and predicts important equipment set-up parameters.

The contractor validated the analytical model with physical models, and these physical models, representative of the analytical model simulations, were used to determine the forming characteristics of those materials under various forming conditions.

Besides the military applications, the technology developed in this system may be transferable to other commercial applications in areas such as the automotive, appliance, consumer, and medical communities.

Historically black college and university effort tries to lessen replacement part production time

The Department of Defense maintains many aircraft which are obsolete but still functional. As parts to these aircraft require repairs, the supply of replacement parts diminishes, and though some of these parts are no longer manufactured, they still must be repaired or replaced. The current practice involves several months, with a Computer Aided Design (CAD) expert measuring the original part and creating a three-dimensional CAD model of it so that the replacement part can be machined. This process can be very time consuming and take the aircraft under repair out of service for an extended period of time. DoD needs a faster turnaround on the manufacture of these parts so that the aircraft returns to service as soon as possible.

Engineers from the Wright Laboratory Manufacturing Technology Directorate are working with the Florida International University on a program which will try to develop a laser scanning reverse engineering process to obtain CAD models of aircraft structural parts and integrate these models with an existing concurrent engineering system to remanufacture these parts.

The Laser-Based Reverse Engineering and Concurrent Systems project will use aircraft structural parts with a laser scanner to provide a three-dimensional CAD model of the part. Engineers will then determine the error ratio between the scanned CAD model and the original drawings, correct errors found, manufacture the part and compare it to the original.

This program hopes to demonstrate the use of laser scanners to speed the process. By scanning these aircraft parts, in just days rather than months, the three-dimensional CAD model can be completed and the part machined in a shortened time span. This program will attempt to prove that the use of laser scanners will help speed the process, will address a needed requirement for the different departments of DoD, and will also provide direction for the commercial industries.

The project is part of the historically black college and university (HBCU) and minority institution (MI) effort. This provision of the United States Code is a goal for DoD for each of fiscal years 1987 through 2000 to award five percent of contract and subcontract dollars to small disadvantaged business concerns and HBCU/MIs; and requires a separate goal, for each of fiscal years 1991 through 2000 as a subset of the five percent goal, for the participation of HBCUs and MIs. DoD uses outreach efforts, technical assistance programs, advance payments, set-asides, and evaluation preferences to meet its contract and subcontract goal for use of HBCUs and MIs. DoD has also established "infrastructure assistance" in the form of scholarships, faculty development, teaming agreements with defense laboratories, and laboratory renovation at institutions that agree to bear a substantial portion of the costs associated with the programs. A list of HBCUs/MIs is published periodically by the Department of Education.

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Contract Number:
F33615-96-C-5616

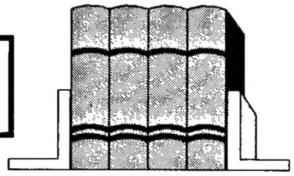
For more information, circle Reader Response Number 6

End of Contract Forecast

DATE	PROJECT TITLE CONTRACT NO.	PRIME CONTRACTOR	POINT OF CONTACT
March 1997	Green Card: A Biopolymer Based and Environmentally Safe Printed Wiring Board Technology F33615-95-C-5509	International Business Machines Corporation, Thomas J Watson Research Center Yorktown Heights, NY	Ronald Bing (937) 255-2461
March 1997	Manufacturing of Thermoplastic Composite Preferred Spares (MATCOPS) F33615-91-C-5717	Northrop Grumman Corporation El Segundo, CA	Diana Carlin (937) 255-7277
March 1997	Design and Manufacture of Low Cost Composites (DMLCC), Fuselage F33615-91-C-5716	Boeing Company, Military Airplane Division Seattle, WA	Daniel Brewer (937) 255-7278
March 1997	Integrated Process Planning/Production Scheduling (IPPPS) F33615-95-C-5523	Raytheon Company, Missiles Systems Division, Tewksbury, MA	John Barnes (937) 255-7371
March 1997	Development of a Low Cost Environmentally Benign All-Sputtered Fabrication of Thin Film Transistors (TFTs) for Active Matrix Liquid Crystal Displays (AMLCD) F33615-94-C-4446	Intevac Incorporated Santa Clara, CA	Robert Cross (937) 255-2461
March 1997	Below-A-Minute Burn-In (BAMBI) for Known Good Die F33615-94-C-4432	Innovative Systems & Technologies Tampa, FL	Bill Russell (937) 255-7371
March 1997	Practice-Oriented Masters Engineering Program F33615-94-1-4422	Ohio State University Columbus, OH	Theodore Finnessy (937) 255-8589
March 1997	National Excellence in Materials Joining Education & Training (NEMJET) F33615-94-1-4416	Ohio State University, Department of Welding Engineering Columbus, OH	Theodore Finnessy (937) 255-8589
March 1997	Minnesota Consortium for Defense Conversion F33615-94-2-4417	Minnesota Technology Incorporated Minneapolis, MN	Cliff Stogdill (937) 255-8589
March 1997	Kansas Manufacturers Association F33615-94-2-4419	Kansas Manufacturers Incorporated Wichita, KS	Kevin Spitzer (937) 255-2413
March 1997	Improving Manufacturing Processes in Small Manufacturing Enterprises (SMEs) F33615-94-2-4418	Higher Education Mfg Process Applications Consortium, St Cloud, MN	Cliff Stogdill (937) 255-8589
March 1997	Low Cost Electrode Fabrication Process for High Definition System (HDS) Color Flat Panel Displays (FPDs) F33615-94-C-4411	Photonics Imaging Northwood, OH	Robert Cross (937) 255-2461
March 1997	Improved Emissive Coatings for Super High Efficiency Color AC-PDPs F33615-94-C-4408	Photonics Imaging Northwood, OH	Robert Cross (937) 255-2461
March 1997	Precision Thick Film Technology for 100% Yield of Large Area High Resolution Color AC-PDPs F33615-94-C-4406	Photonics Imaging Northwood, OH	Robert Cross (937) 255-2461

DATE	PROJECT TITLE CONTRACT NO.	PRIME CONTRACTOR	POINT OF CONTACT
March 1997	National Industrial Information Infrastructure Protocols (NIIIP) F33615-94-2-4447	International Business Machines Corporation Stanford, CT	John Barnes (937) 255-7371
April 1997	Textile/Apparel Initiative (Flexible Manufacturing/Information Exchange in a Textile Enterprise) F33615-94-C-4430	Georgia Institute of Technology, School of Textile & Fiber Engineering Atlanta, GA	Paul Bentley (937) 255-7371
April 1997	Tertiary Recycling of Electronic Materials F33615-95-C-5507	Adherent Technologies Incorporated Albuquerque, NM	Ronald Bing (937) 255-2461
April 1997	Large Aircraft Robotic Paint Stripping (LARPS) F33615-91-C-5708	United Technologies Corporation Huntsville, AL	David See (937) 255-3612
April 1997	Spare Part Production & Reprocurement Support System (SPARES) F33615-90-C-5002	General Atomics Corporation San Diego, CA	John Barnes (937) 255-7371
April 1997	Smart Valley CommerceNet F33615-94-2-4413	CommerceNet Consortium Palo Alto, CA	Brian Stucke (937) 255-7371
May 1997	Precision High Speed Machining with Vibration Control SPO900-94-C-0010	McDonnell Douglas Corporation, Aerospace Division, St Louis, MO	Rafael Reed (937) 255-2413
May 1997	Design and Manufacture of Low Cost Composites (DMLCC), Wing F33615-91-C-5720	McDonnell Douglas Corporation, Aircraft Division, St Louis, MO	Kenneth Ronald (937) 255-7278
May 1997	Metrics for Agile Virtual Enterprises F33615-95-C-5513	Sirius-Beta Virginia Beach, VA	Paul Bentley (937) 255-7371
May 1997	Manufacturing Assembly Pilot (MAP) Project F33615-95-2-5518	Automotive Industry Action Group Southfield, MI	Cliff Stogdill (937) 255-8589
May 1997	Activity-Based Costing for Agile Manufacturing Control F33615-95-C-5516	Industrial Technology Institute Ann Arbor, MI	Cliff Stogdill (937) 255-8589
May 1997	Development of Co-Optimized Rapid Thermal Process (RTP) and a Silicon Deposition Statistical Process Control (SPC) Process for Cost Reduced LCD Manufacturing F33615-94-C-4449	Intevac Incorporated, Rapid Thermal Processing Systems Rocklin, CA	Robert Cross (937) 255-2461
June 1997	Laser Cleaning & Coatings Removal (LCCR) F33615-95-C-5515	F2 Associates Incorporated Albuquerque, NM	Michael Waddell (937) 255-7277
June 1997	Decision Support System for the Management of Agile Manufacturing F33615-95-2-5525	Phillips Laboratory Incorporated Briarcliff Manor, NY	Wallace Patterson (937) 255-8589
June 1997	Integrating People, Products, Processes F33615-95-C-5546	Texas Instruments Incorporated, Defense Systems & Electronics Group, Dallas, TX	Charles Wagner (937) 255-2461
June 1997	Flexible Laser Automated Intelligent Research System for Manufacturing and Fabrication F33615-95-C-5503	American Welding Society Miami, FL	Rafael Reed (937) 255-2413

Reports



Abductive Information Modeling (AIM) Voice Understanding and Software Process and Quality Assessment Tool Feasibility Study

Alog Number: 3824
Contract Number: F33615-94-C-4444
Technical Report Number: WL-TR-96-8011
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Contribution to Virtual Manufacturing Background Research, Phase II

Alog Number: 3835
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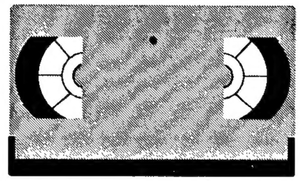

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Spring 1996

The USAF Manufacturing Technology

PROGRAM STATUS REPORT

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